PC 99 System Design Guide Version 0.7 Review Draft

A Reference for Designing PCs and Peripherals for the Microsoft® Windows Family of Operating Systems

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IMPORTANT: This is a working draft of proposed revisions to the system design guidelines, subject to change and addition throughout the industry review process.

Intel Corporation and Microsoft Corporation

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To obtain additional copies of the PC 99 document, please download the source files from the web sites at:

http://developer.intel.com/design/desguide/
http://www.microsoft.com/hwdev/pc99.htm

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There are no proposed changes for the appendix in this review.

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Preface

Thank you for your interest in the Version 0.7 review draft of the proposed requirements and recommendations for *PC 99 System Design Guide*.

Review Comments. Please use the forms in the Word download package to provide comments on Version 0.7.

If you provide comments about requirements related to key PC 99 initiatives (such as the ISA-removal initiative), please include alternative proposals that will meet the goals of the initiative while addressing the business needs of the industry.

Also, in preparing your comments, please remember that not all requirements take effect on July 1, 1999. If you cannot comply with a proposed requirement by July 1, 1999, please provide information about when you believe compliant components can be implemented in your production line.

Schedule. The following deadlines are planned for the PC 99 review process:

- **By May 26: Comments due on Version 0.7 draft**
- By June 15: Version 0.9 draft posted on PC 99 web sites
- **By July 1: Final comments due**
- By July 15 (est.): Version 1.0 posted on PC 99 web sites

The complete design guide text will be published in book form by Microsoft Press later in Q3 1998.

For up-to-date information about the PC 99 draft and review process, see:
http://www.microsoft.com/hwdev/pc99.htm
http://developer.intel.com/design/desguide/

Reviewer Registration. If you want to be registered as a PC 99 reviewer, please send e-mail to **pc99@microsoft.com** or **pc99@intel.com**. Please include your name, title, company name, and phone and fax numbers. Also, please note that all mail received at these aliases is shared among the co-authors at Intel and Microsoft. The co-authors request that only one individual per division in each company register and submit review comments.

Again, thank you for your interest and time in reviewing these proposed changes. Your extensive contributions have been invaluable in preparing these guidelines.

— The PC 99 co-authors at
Intel Corporation and Microsoft Corporation

Welcome

This guide is for engineers who build personal computers, expansion cards, and peripheral devices that will be used with the Microsoft® Windows® 98 and Windows NT® version 5.0 operating systems. The goal of this document is to provide guidelines for hardware design that will result in the optimal user experience, particularly when the hardware is used with the Windows family of operating systems.

This guide is co-authored by Intel Corporation and Microsoft Corporation. The requirements and recommendations in this guide outline features that the hardware industry should consider in designing PCs and peripherals for various price levels and performance levels.

The clarifications, changes, and additional requirements in this guide define extensions to the requirements defined in *PC 98 System Design Guide* (Microsoft Press, 1997; ISBN 1-57231-716-7) defined for 1998–99.

This guide includes PC 99 requirements for basic consumer and office implementations, such as desktop, mobile, and workstation systems, and for Entertainment PCs. In this guide, the following requirements are defined:

- Design requirements for specific types of systems that will run either Windows 98 or Windows NT operating systems
- Design requirements related to the OnNow design initiative, including requirements related to the Advanced Configuration and Power Interface (ACPI) specification, Plug and Play device configuration, and power management in PC systems
- Manageability requirements that focus on improving Windows 98 and Windows NT, with the end goal of reducing total cost of ownership (TCO)
- Clarifications and additional design requirements for devices supported under Windows 98 and Windows NT, including new graphics and video device capabilities, DVD, scanners and digital cameras, and other devices

This guide does not address PC systems designed to act as servers in networked environments. It also does not address non-PC handheld computers running on the Microsoft Windows CE operating system.

Important: The system requirements defined in this document provide guidelines for designing PC systems that deliver an enhanced user experience when implemented with Windows 98 and Windows NT operating systems. These design requirements are not related to the minimum or optimal system requirements for running the Windows family of operating systems. For information about minimum system requirements for both operating systems, see the web site at http://www.microsoft.com/windows/.

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How to Use This Guide

The PC 99 requirements are defined by system type and for individual bus classes and device classes. This guide is divided into four chapters, plus appendixes, with each chapter addressing a particular element of PC 99 design.

Part 1: System Design Issues. Introduces the important design issues for PC 99. Study this part first to understand the key design issues being addressed in the PC 99 requirements.

Part 2: PC 99 Systems. Presents system-type definitions and PC 99 requirements for each system type. Study this part for an understanding of the overall system requirements.

Part 3: Bus Design Guidelines. Presents requirements for each bus type and I/O host controller supported under Windows 98 and Windows NT. Study this part for a detailed understanding of how buses and controllers are to be implemented on PC 99 systems.

Part 4: Device Design Guidelines. Defines design requirements for each particular device type, whether the device is an integral part of a PC system or designed as an add-on device. Study this part for a detailed understanding of the design requirements for each device type.

Appendixes. *(not in this review)* Includes the PC 99 checklist, which summarizes all the requirements defined in this guide, plus other technical appendixes.

Updates to this guide, technical clarifications, and answers to frequently asked questions are available on the following web sites:

http://www.microsoft.com/hwdev/pc99.htm
http://developer.intel.com/design/desguide/

Required vs. Recommended PC 99 Features

In this guide, hardware features are described as *Required*, *Recommended*, or *Optional*. For PC 99, these terms are used to mean the following:

- **Required:** These basic features must be implemented in order for hardware to comply with PC 99 requirements.
- **Recommended:** These features add capabilities that are supported by the Windows family of operating systems. Recommended features take advantage of the native capabilities of the device drivers included with the operating system, usually without imposing major cost increases.

  Notice that for compliance testing, if a recommended feature is implemented, it must meet the requirements for that feature as defined in this guide.

  Note: If it is planned that a specific recommended feature will become a requirement in future versions of these guidelines, it is specifically noted in the text.
- **Optional:** These features are neither required nor recommended, but if the feature is implemented in a PC 99 system, it must meet the specified requirements. Optional features will not become requirements in the future.

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In this guide, these words can be understood as follows with regard to PC 99 requirements:

- **Must:** Required
- **Should:** Recommended

Important: The requirements and recommendations in this guide are often provided in the form of references to industry specifications. These specifications might contain intellectual property of Intel, Microsoft, or other third parties. Each of these industry specifications might have different intellectual property licensing arrangements. It is the responsibility of the original equipment manufacturer (OEM) to consult these industry specifications or their issuance bodies for licensing specifics or details.

Conventions Used in This Guide

The following conventional terms are used throughout this guide. In addition, see the Hardware Glossary in the References part of this guide.

Convention	Meaning
Add-on device	Refers to devices that are traditionally added to the basic PC system to increase functionality. Examples include audio, networking, graphics, small computer system interface (SCSI) controller, and so on. Add-on devices fall into two categories: devices built on to the system board and devices on expansion cards added to the system through a system-board connector, such as Peripheral Component Interconnect (PCI).
Intel Architecture	Refers to computers based on 32-bit microprocessors that use the Intel Architecture instruction set, such as Intel® 80486, Intel Pentium®, Intel Pentium with MMX™ technology, Pentium Pro, Pentium II, or compatible processors. MMX technology refers to Intel's media-enhancement technology that includes new instructions to the Intel Architecture instruction set.
PC 99	Collection of the additional requirements and recommendations defined in this guide that make up the 1999–2000 requirements for PC system design.
DEC Alpha	Refers to Windows NT-compatible computers based on reduced instruction set computing (RISC) architecture. Notice that all requirements and recommendations for DEC Alpha PCs are for the Windows NT operating system only.
System device	Also *on-board device*. Refers to devices on the system board such as interrupt controllers, keyboard controller, real-time clock, direct memory access (DMA) page registers, DMA controllers, memory controllers, floppy disk controller (FDC), Integrated Device Electronics (IDE) ports, serial and parallel ports, PCI bridges, and so on. In today's PCs, these devices are typically integrated with the supporting chip set.
Windows	For PC 99, refers to the Microsoft Windows 98 operating system, including any add-on capabilities and any later versions of the operating system.
Windows NT	For PC 99, refers to the Microsoft Windows NT Workstation version 5.0 operating system, including any add-on capabilities and any later versions of the operating system.

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PC 99 and the “Designed for Microsoft Windows” Logo Program

Microsoft will refer to the requirements and recommendations in this guide when defining requirements for the 1999–2000 “Designed for Microsoft Windows” hardware logo program. The “Designed for Microsoft Windows” logo program was developed by Microsoft to help end users easily identify hardware and software products designed specifically for the Windows and Windows NT operating systems.

The logo program provides customers with the assurance that their hardware works with the Windows family of products, with an emphasis on how the system performs when running commercially marketed desktop applications. The end result Microsoft is seeking is lower cost of support for both vendors and users.

Licensing the logo enables vendors to use the logo on web sites, product packaging, advertising, collateral, and other marketing materials. The logo indicates to customers that the product is designed to meet a specific set of standards and to provide an optimal experience when run on either a Windows or Windows NT operating system.

Logo Compliance Dates. In general, the PC 99 requirements go into effect on July 1, 1999, for the “Designed for Microsoft Windows” logo. Compliance testing for some requirements will begin later because of the time required for silicon changes to become widely available. For information about actual compliance testing dates for specific requirements, see the web site at http://www.microsoft.com/hwdev/desguide/.

Logo Testing. Both hardware and software are tested before rights to use the “Designed for Microsoft Windows” logo are granted. The testing organization for the logo program is the Windows Hardware Quality Labs (WHQL), which provides compatibility testing services for Windows and Windows NT hardware and drivers.

Hardware developers whose products pass the WHQL testing program also receive a detailed test report, inclusion of tested hardware on the Windows Hardware Compatibility List (HCL), and free distribution of drivers in the Windows Driver Library (WDL).

If you have questions about the program, contact WHQL:

Windows Hardware Quality Labs
Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399 USA

http://www.microsoft.com/hwtest/
E-mail: whqlinfo@microsoft.com
Fax: (425) 703-3872

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References

The following table lists some of the information resources, services, and tools available from Intel and Microsoft to help build hardware that is compliant with the PC 99 requirements. In addition, each chapter in this guide contains a reference section.

Resource	Address
Intel information for developers	http://developer.intel.com
Microsoft information for hardware manufacturers	http://www.microsoft.com/hwdev/ E-mail: ihv@microsoft.com
Windows and Windows NT DDKs	Provided with Microsoft Developer Network (MSDN) Professional membership. To subscribe: Fax: (425) 936-7329, Attn: Developer Network E-mail: msdn@microsoft.com http://www.microsoft.com/msdn/subscribe/
Hardware testing tools	http://www.microsoft.com/hwtest/

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CHAPTER 1

PC 99 System Design Issues: Executive Summary

The following summarizes the key changes proposed for PC 99, in comparison to the requirements and recommendations defined in *PC 98 System Design Guide*.

PC 99 Proposed General System Requirements

- **System performance.** Proposed performance is equivalent to Intel Architecture 300-MHz processor with Intel MMX technology, 128K Level 2 (L2) cache, and 32 MB RAM.

  64 MB minimum is required for Office PC 99.
- **ACPI and BIOS support.** Clarifications to ACPI and BIOS support requirements, including BIOS support for USB keyboards and hubs for all system types.
- **Bus and expansion capabilities.** The proposed changes include:
  - Two USB ports (one for mobile PCs).
  - Support PCI 2.1 if PCI bus is present, including the Vaux support and the subsystem ID requirements for buses that remove power to devices during System S3 or Bus B3.
  - No ISA expansion devices *or slots*. Legacy motherboard implementations such as Super I/O are allowed.
- **Storage and media playback.** 2X DVD-ROM is recommended for Consumer and Office systems that provide optical media devices, and it is required for Entertainment PCs. IEEE 1394 is recommended for the secondary storage host controller.
- **Communications.** The proposed changes include:
  - 56-Kbps V.90 modem is required or other public network communication capabilities for Consumer and Entertainment PCs.
  - A network adapter is required for Office PCs and recommended for Consumer and Entertainment PCs.
- **Graphics subsystem.** The proposed changes include:
  - AGP is recommended for the primary adapter.
  - Clarifications of graphics adapter support for 3-D hardware acceleration.
  - Monitor must be compliant *Display Data Channel Standard, Version 3.0*,Level B (DDC2B).

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Workstation PC 99 Proposed Requirements

- Proposed performance is equivalent to Intel Architecture 400-MHz processor with 256K L2 cache, and 128 MB RAM.

Entertainment PC Proposed Requirements

- Most features exceeding Consumer PC 99 requirements are described as recommendations, rather than specific feature requirements.
- Entertainment PC capabilities are still defined in terms of specific performance and quality measures.

Mobile PC Proposed Requirements

- **Mobile system performance.** Proposed performance is equivalent to an Intel Architecture 266 MHz processor with 128K L2 cache, or equivalent performance, plus 32 MB RAM
- **Mobile power management.** Many clarifications and changes to improve the definition of power management concerns for this form factor, including a new recommendation to support *Mobile Power Guidelines '99, Revision 1.0*.
- **Mobile graphics subsystem.**
  - Clarification of internal graphic sadapter requirements.
  - 3-D features are still recommended, but if implemented, new resolution and performance requirements are defined.
  - Minimum performance requirements if video playback capabilities are implemented.
- **Docking capabilities.** Clarification of requirements for docking capabilities.

Bus Proposed Requirements

Several clarifications and additions are proposed for each bus class. Key items—especially those related to revised industry specifications—include:

- All USB hardware complies with *USB Specification, Version 1.0,*.
- All IEEE 1394 hardware, if implemented, complies with IEEE p1394a standard and OpenHCI.
- All PCI components comply with *PCI Local Bus Specification, Revision 2.1*, plus clarification to the requirement related to PCI bus power management.
- Clarification to PC Card and CardBus requirements related to required tuples.

Device Class Proposed Requirements

I/O Ports and Devices

- I/O ports and devices clarifications about requirements and recommendations related to IrDA 1.1, IrDA Data, and IrDA Control specifications, plus related USB guidelines.
- Clarification of the requirement that the system provide a separate, physically-isolated transceiver for each infrared (IR) protocol the system supports.

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Graphics Adapters

- Clarification of resolution and local memory minimum requirements.
- Minimum support for one off-screen video overlay surface.
- Programmable blter stride required for 2-D acceleration.
- Clarifications to 3-D hardware acceleration.
- Clarifications to supporting requirement for television output capabilities.
- Requirements for better video scaling.

Video and Broadcast Components

- Requirements and recommendations related to support for receipt and MPEG decoding of digital television broadcasts, including absence of banding related to poor scaling methods.
- Recommendation for separation of “receiver” functions from “display” functions, with the two being linked by software running on the host processor.
- Device Bay and other IEEE 1394 devices are introduced as a way of implementing television receiver modules.
- Requirements and recommendations related to generally increased video quality on the PC.

Monitors

- Requirements for monitors to synchronize to valid formats within a specified time.
- Monitors must support *Display Data Channel Standard, Version 3.0*.

Audio

- Incremental changes to audio performance requirements.
- No legacy hardware interfaces for MS-DOS window (legacy interfaces used only in MS-DOS mode).
- Other new requirements to advance scalable audio.

Modems

- Modem supports V.250 AT command set, V.90 analog modem modulation, V.80 synchronous access and V.8 *bis* call control signaling.
- Voice modem supports ITU V.253.
- Driver-based modems must use a WDM-based driver solution, with new performance criteria recommended.

Network Communications

- Most of the changes to network requirements and recommendations in PC 99 address issues related to providing better performance or higher bandwidth for multimedia-enabled networking and to ensuring easier configuration of the devices and drivers.
- NDIS 5.0 miniports are required for network adapters. The biggest impact of this requirement is the implementation of the drivers for connection-oriented media.

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- Voice support requirements are proposed for ISDN devices.
- Revisions and additional details are provided for cable modem and ADSL devices.
- New requirements are defined for infrared devices.
- New requirements and guidelines for home networking.

Digital Still Image Peripherals

- Driver support must be implemented under the Still Image architecture, with WDM minidrivers required for digital cameras that can create video streams.
- Use of a PC-compatible file system for removable storage.
- Requirements for compatibility with Windows NT 5.0 support and for emerging standards, including TWAIN 1.7.
- IR implementations must be based on the Windows Sockets interface, because IRComm is not supported in Windows NT 5.0.
- Bandwidth management is required for USB imaging devices, including no pre-allocation of bandwidth and a strong recommendation to limit USB bandwidth use to 8 Mbps.

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C H A P T E R 2

PC 99 Design Initiatives

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